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Some Notes on the

Oiling of Wool

By C. H. S. TUPHOLME

AS IS well known, wool in the raw state contains a considerable amount of wool grease, suint, and dirt, and must usually be washed before being manufactured into yarn and cloth. Scouring removes all but a small residue of grease in the wool, and it is necessary to apply oil to facilitate easy passage of the wool through the carding and spinning processes which are to follow. The surface of the wool fiber is rough and serrated, with the result that the fiber when drawn against any other object, exhibits a greater resistance to motion in one direction than in the other. The object of applying oil to wool, is to equalize this friction, so that the fibers may slide with equal ease in either direction.

It is essential that the oil be as widely distributed and as finely spread as possible, and anything which assists in the distribution of the oil improves results during carding and spinning.

The old method of merely throwing the oil on to the blend, is not adequate; the various sprayers which are now available are a distinct improvement. If, in addition to using a sprayer, the oil itself can be so prepared as to render it emulsifiable, water can be used with the oil so as to increase dispersion. Mere stirring or mixing together of oil and water is not always sufficient. Unless the water and oil reach the wool in a state of emulsion some of the fibers are oiled and some are merely watered. A bond is essential, therefore, to prevent separation until after the emulsion has reached the wool. When the water has actually carried the oil on to the wool, it matters little how soon it evaporates, because its dispersive and distributive work has been done.

Common soda or potash are sometimes recommended for preparing emulsions, but ammonia gives much better results. Gums and similar materials used as stabilizers to emulsify otherwise non-emulsifiable oils, are not to be recommended, because of the liability of some to cause stickiness on the wool. Some of the so-called emulsifiers on the market are really "wetting-out" agents and their cost is very high compared with ammonia.

In whatever way the oil has been applied, it is always an advantage if the oiled blend can be allowed to rest for some time before further processing, as this greatly improves evenness of distribution of the oil. It should here be emphasized that any effort to increase even oil distribution at this stage is amply repaid by improved working on the cards and mule.

The first step in testing an oil for use on wool is to separate any water, gum, soap, etc., leaving the oil itself free for further examination. The presence of "added matter" such as water, soap, gum, etc., affects certain tests. An oil and water emulsion might show a perfectly safe flash point, "Mackey" test (because of the water), though the oil from which the emulsion had been made might be below the insurance limits.

The value of an oil frequently depends upon the "Saponifiable Percentage" test, which also is a guide to insurance companies when classifying the oil for tariff charges in woolen and worsted mills. "Saponifiable Percentage" is different from "Saponification Value," which indicates the amount of alkali required for saponification. In many oils, this figure is roughly twice the "Saponifiable Percentage." The term "Saponifiable Percentage" is perhaps misleading to some people; it is possible to have an oil 100 per cent saponifiable, which would be difficult to scour. The "Saponifiable Percentage" should be noted in conjunction with free fatty acidity.

A useful guide as to probable scouring properties is the free fatty acidity; it also has a bearing on the risk of metal stains. The quality of free fatty acids in a wool oil is as important as the quantity. Free fatty acidity is different from acid value, which indicates the amount of alkali required to neutralize the free fatty acids present in an oil. In many oils, this figure is roughly twice that of the free fatty acidity.

A good wool oil should have a flash point of not less than 340° F. (this is the figure accepted by insurance companies in England). Water or other added matter should be removed before testing the flash point.

The condition of the oil at various temperatures should be noted; this is quite as important as the temperature at which it actually freezes. An oil which thickens evenly without throwing down pasty "foots," will usually card and spin better in cold weather than one which deposits layers of hard "foots," sometimes difficult to remelt.

"Cloudiness" in an oil may be due to very slight traces of water, which looks worse than it really is.

Some test of the oxidizing power of an oil is most important, because the capacity and rate of absorbing oxygen indicate the heating and, to a certain extent the staining qualities of an oil.

The two main tests are:—

Iodine Value, which indicates the capacity of an oil to absorb oxygen. This test by itself is not sufficiently comprehensive, and should be considered, together with the—

Mackey Test, which indicates the rate of oxygen absorption.

The Mackey Tester is a useful instrument for the purpose of comparing various oils; the tests, however, should be made by the same observer.

As some guide to the oxidizing and staining risks of an oil, further tests can be made upon rancidity, oxidation, and polymerization. These tests are rather lengthy, but they should be carried out periodically.

Rancidity and oxidation are not the same thing, though both may be produced at the same time. Rancidity is brought about by the action of certain organisms, while oxidation is a purely chemical action between oil and oxygen.

The effect of polymerization is to render the oil thick and gummy, without, however, any addition of oxygen taking place. Usually, in the case of oil on wool, both oxidation and polymerization occur together, and sometimes rancidity is induced as well. Oils vary enormously in their reactions to light, air, and rancidifying bacteria.

The Mackey test, previously referred to, used in the textile industry for determining the combustibility of the olein employed in dressing textiles, has in recent years been the subject of a good deal of experiment and discussion on the Continent, and a description of this was published in *The Oil and Colour Trades Journal,* from which the following extract is taken:

The German Research Institute for the textile industry has just published its sixth monograph on olein, and devotes practically the whole of it to an examination of the Mackey apparatus, and offers suggestions for its improvement. Strongly unsaturated acids, such as linoleic and linolenic, absorb oxygen from the air, and thus become viscous and rancid, and, finally, when in a thin layer, set hard. If this takes place with olein in a textile fabric, heat is produced, causing ultimately spontaneous combustion or, at least, spoiling the fabric.

The purpose of the Mackey apparatus, the simple construction of which is well known, is to test the rise in temperature of an olein-treated fabric in a given time, and if there is any appreciable rise in temperature the olein contains unsaturated fatty acids and is not suitable for textile work. Even if combustion does not actually occur, the heating and other effects on the textile are very injurious, causing bad color, unpleasant smell, reduced tensile strength, and so forth. It is true these defects may also be caused by other factors, but unsuitable olein is responsible for much.

What is of chief interest in this work is the emphasis laid on catalytic action, and on the real causes and proper interpretation of the effects observed, e.g., the large temperature rise with olive oil, fatty acids or other acid oils. It seemed desirable to examine the rise in temperature from other points of view than percentage of unsaturated acid present and oxygen absorption.

Dr. Kaufmann, therefore, has recently tried the "rhodanometric" method, and discovered, in the difference in iodine values as given by the iodometric and rhodanometric methods, a fairly certain indication of the amount of strongly unsaturated acids present in a mixture of fatty acids. The writer of the German Textile Research Institute monograph, Dr. Kehren, confirms the existence of a catalytic effect. Mackey and Ingle themselves had already pointed out that the rise in temperature in an oil is intensified by the presence of metallic soaps, which doubtless act as oxygen carriers, especially soaps of cobalt, lead, manganese and chromium.

It may be that in testing for temperature rise in olein these soaps are unimportant; in this case, the factor to be noted is the amount of iron soap dissolved in the olein, the catalytic effect of which is indicated by Kehren in a previous paper.

Olein samples sent for test are seldom free from iron, which they easily absorb from contact with iron vessels during transport or otherwise. Iron soaps are thus formed having a marked catalytic and temperature-raising effect.

It may thus happen that a sample of olein practically free from unsaturated acids will, toward the end of the Mackey test, i.e., after 60 to 90 minutes, develop a decided rise in temperature, which must be attributed solely to the catalytic action of the iron soap present, formed possibly by contact with the iron gauze container of the Mackey apparatus itself.

It is desirable to test all oleins for iron content, and it will frequently be found that, after removal of all trace of iron, there is no appreciable rise in temperature. Moreover, it is obviously necessary to use some other metal than iron, such as brass, aluminum or copper, in the construction of the Mackey apparatus, at least of the wire or gauze container.

Kehren, in his rather verbose and lengthy report, says first that he obtained quite satisfactory results when he used a brass container, but afterwards he suggests that brass is not at all suitable and promises to go still more fully into the matter in a subsequent article! Another point to be noted is the uniform or otherwise access of air to the sample under test, as this will obviously affect

(Continued on page 25)

PROCEEDINGS OF THE

American Association of Textile Chemists and Colorists

JANUARY 14, 1935

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CALENDAR OF COMING EVENTS:

Meeting, New York Section, Chemists' Club, New York City, January 25th.

Council and Research Committee Meetings, Friday afternoon, January 25th, Providence Engineering Society, 195 Angell Street, Providence, R. I.

Meeting, Rhode Island Section, Friday evening, January 25th, Providence Engineeering Society, 195 Angell Street, Providence, R. I. President Robert E. Rose will speak.

FOURTEENTH ANNUAL MEETING

Saturday Morning Session

December 8, 1934

The meeting convened at nine-thirty o'clock, President Rose presiding.

President Rose: The technical meeting will please come to order.

The schedule, I think you will agree, is running pretty well on time and we hope to keep to it. In that connection, I will say that the speakers have a certain time allotted to them, a time which they knew was to be theirs. We will ask each speaker to get as much into the time allotted to him as possible, but beyond that we can give him no further time.

The first paper on the program is on, "Absorption of Moisture by Aeronautical Textiles," by G. M. Kline of the United States Bureau of Standards.

. . . Mr. Kline presented his prepared paper, illustrating with slides . . . (Applause).

Proceedings of the American Association of Textile Chemists and Colorists

Absorption of Moisture*†

By GORDON M. KLINE

By Aeronautical Textiles

THE ability of textile materials to take up or lose moisture when exposed to an atmosphere of varying relative humidity is well known. An important part of the textile chemist's handbook consists of the standard "regain" tables which enable him to calculate the moisture content of his yarns for any given temperature and relative humidity. The analytical chemist is concerned with this moisture content because of its variable effect on the weight of his sample. The chemical engineer has learned that it is a fundamental factor in the efficient processing of the textiles in the mill. The aeronautical engineer has come to realize that this characteristic property of textile materials, namely, to change their moisture content with varying atmospheric humidity, is equally of interest in his field where weight is a predominant factor.

Few people realize how great a share textile materials have in the fabrication of aircraft. It is an amazing fact to most of us that the visible portions of our service airplanes and airships consist almost entirely of fabric coated with a cellulose plastic. The addition of aluminum powder to the outer layers of the coating material imparts a metallic appearance which is very deceptive. Cotton cloth owes its prevailing use in the construction of aircraft to its relatively great tensile strength. Accidents to aircraft because of failure of their fabrics are rarely recorded. It is interesting to note that the outer cover of the United States dirigible "Macon" contains approximately 32,000 square yards of fabric which, including the coating material, weighs nearly 6 tons. The gas cells in this ship contain another 54,000 square yards of fabric which together with the applied material weighs about 9 tons. It can readily be seen that any tendency of these fabrics to take up moisture will have an important bearing on the load which the airship is required to support. On our airplanes, cloth is stretched over the fuselage and wings and is doped with a plastic cellulose derivative to obtain tautness, impermeability, and durability. During the application of the dope the presence of any considerable amount of moisture is undesirable because of its tendency to precipitate the cellulose derivative, a phenomenon commonly called "blushing." The absorption of moisture by the finished product is objectionable, not only because of the increased weight, but also because of its effect on the tautness of the fabric.

Very few data are available in the literature relative to the amount of water held by airplane, airship, and gas-cell fabrics, doped and undoped, at various relative humidities. W. G. Bird[1] in an article entitled "The Influence of Atmospheric Humidity and Other Factors Upon the Static Lift of Airships" presents the results of a few experiments with gas-cell fabric made with goldbeaters' skin and doped (type unstated) outer cover cloth at 90-95 per cent and 100 per cent relative humidities and various temperatures. His investigation was undertaken following the crash of the British dirigible R. 101 and involved not only the hygroscopic nature of the gas-cell fabric and outer cover, but also the increase of apparent weight caused by the impact of raindrops on the hull of an airship and the weight of the "free" water which collects there during precipitation. The "impact" and "free" water factors were found to be of insufficient magnitude to seriously disturb the operation of the airship during even cloudburst conditions of rainfall. The maximum amount of moisture capable of being held by the gas-cell fabric made with goldbeaters' skin was approximately 70 per cent of its dry weight. The outer cover of the R. 101 immersed in water increased in weight about 28 per cent, but on exposure over water returned to a moisture content of about 8 per cent. The scheduled weight of the gas bags of this airship was 7.3 tons and that for the outer cover was 4.35 tons, so that the maximum increase in weight by absorption of water was found to be about 6 tons. Since the fabrics used on airships and airplanes in this country differ from those studied by Bird, an in-

*Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

†Presented at Annual Meeting, December 8, 1934.

[1] J. Roy. Aeron. Soc. *35*, 973 (1931).

vestigation was undertaken at the National Bureau of Standards with the financial assistance of the Bureau of Aeronautics, Navy Department, to determine the moisture content of these domestic fabrics at various relative humidities.

The method employed consisted in suspending the sample in a glass bottle containing phosphorus pentoxide, saturated salt solutions, or water, according to the relative humidity desired, and weighing the sample at suitable intervals. The apparatus[2] is shown in Figure 1 and the

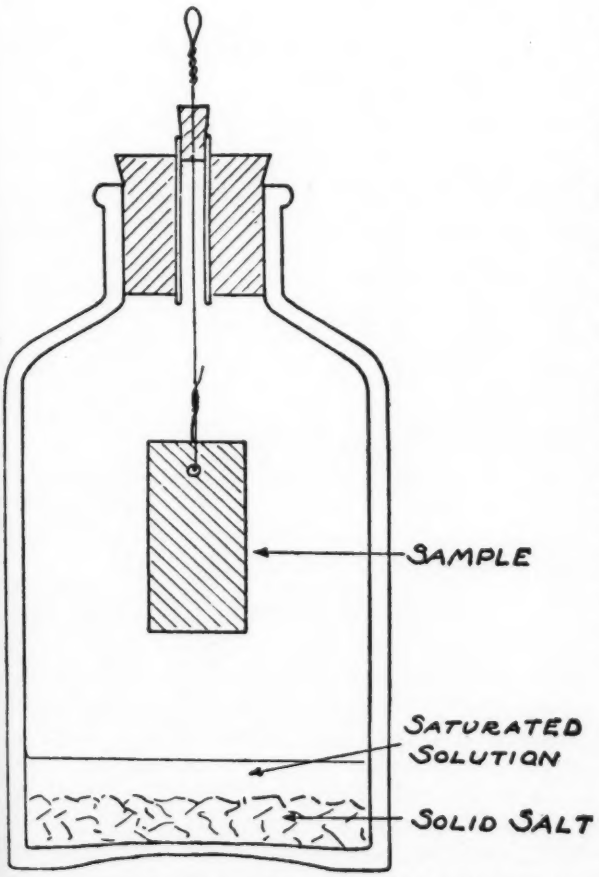

Fig. 1. Diagram of apparatus used in measurement of absorption of moisture.

reagents used to obtain the various relative humidities[3] are listed in Table 1. Another procedure was also used in which air at the desired relative humidity was passed through the bottle containing the sample. The amounts and rates of absorption of moisture were practically the same by the two methods. The maximum changes in weight noted for the aircraft fabrics at the various relative humidities are presented in Table 2. All samples

[2]B. S. J. Research *11*, 147 (1933).

[3]International Critical Tables, First Edition, McGraw-Hill Book Company, New York, *1*, 67.

Table 1—Reagents Used to Obtain Various Relative Humidities

Relative Humidity	*Reagent*
%	
0	Phosphorus pentoxide
86	Saturated potassium chloride solution
94	Saturated potassium nitrate solution
97	Saturated potassium sulfate solution
100	Water

were first conditioned at 65 per cent relative humidity and 21° C. ±1°; the values given in the table are percentage changes in weight from that standard condition.

It will be observed that the materials can be divided into four groups according to their hygroscopic behavior, namely fabrics coated with cellulose nitrate dope, fabrics coated with cellulose acetate dope, uncoated cloths, and gas-cell fabrics. The latter consisted of balloon cloth weighing 2.80 ounces per square yard for the light-weight product and 4.20 ounces per square yard for the heavy-weight material, coated with a mixture of gelatin and rubber latex, containing polyglycerol as a plasticizer. The fabrics coated with cellulose nitrate dope are the least hygroscopic and take up less than 12 per cent moisture even in a saturated atmosphere. The fabrics coated with cellulose acetate dope behave similarly to those coated with cellulose nitrate dope in relative humidities up to and including 97 per cent. At 100 per cent relative humidity the cellulose acetate products show an increase in absorption of water and take up from 30 to 55 per cent water. The results obtained with the mercerized airplane cloth and the unmercerized balloon cloth are in good agreement with the moisture relations found by Urquhart[4] and his colleagues for mercerized yarn and raw cotton. The maximum gain noted in our work was 20.6 per cent on the conditioned basis or 30.1 per cent on the dry basis; Urquhart's maximum value for the absorption of moisture by mercerized cotton yarn initially dried over phosphorus pentoxide was 27.7 per cent. It will be noted that the moisture content of the mercerized cloth is slightly greater than that of the unmercerized product. The gas-cell fabrics absorb much more water than the other aircraft fabrics studied. This is due to the gelatin and polyglycerol present, which are very hygroscopic. Goldbeaters' skin, like gelatin, is a protein material and is plasticized with glycerol when made into gas-cell fabric; it will be recalled that Bird found that gas-cell fabric made with goldbeaters' skin also takes up large amounts of water at high humidities.

Data on the rate of absorption of moisture by the aircraft fabrics were also obtained. With the exception of the gas-cell fabrics equilibrium conditions are approached fairly rapidly. Approximate equilibrium is reached in 24

[4]J. Text. Inst. *15*, T138 (1924); *23* T135 (1932).

Table 2—Change in Weight of Aeronautical Textiles and Dope Films Which Have Been Conditioned in Air at 21° C. and 65 Per Cent Relative Humidity When They Are Exposed at Other Relative Humidities

	Weight Oz./Sq. Yd.	Per Cent Relative Humidity 0 %	86 %	94 %	97 %	100 %
Balloon cloth, unmercerized	2.11	—6.5	3.5	7.1	11.6	18.9
Airplane cloth, mercerized	4.13	—7.3	4.9	9.7	15.3	20.6
Airship outer cover, cellulose acetate doped	5.90	—5.5	2.2	4.5	7.3	55.3
Dope film, cellulose acetate	5.12	—2.6	1.6	2.9	4.0	30.5
Airplane fabric, cellulose nitrate doped	8.89	—4.6	1.7	3.7	5.7	11.8
Dope film, cellulose nitrate	5.52	—1.0	0.5	0.7	1.0	7.7
Gas-cell fabric, light-weight	4.93	—7.8	11.8	30.2	69.9	98.5
Gas-cell fabric, heavy-weight	6.35	—6.8	9.9	24.7	45.3	94.8

Table 3—Gain in Weight at 100 Per Cent Relative Humidity of Various Aeronautical Textiles and Dope Films Which Have Been Conditioned at 21° C. and 65 Per Cent Relative Humidity

	Weight Oz./Sq. Yd.	Time in Weeks 1/7 %	3/7 %	1 %	2 %	3 %	4 %	5 %
Balloon cloth, unmercerized	2.11	10.9	14.0	15.8	18.3	18.6	18.9	18.9
Airplane cloth, mercerized	4.13	12.9	17.0	19.8	20.6	20.6	20.6	20.6
Airship outer cover, cellulose acetate doped	5.90	8.7	12.1	15.7	20.8	24.2	...	31.4
Dope film, cellulose acetate	5.12	5.0	6.5	10.6	13.8	16.5	18.7	21.6
Airplane fabric, cellulose nitrate doped	8.89	5.9	8.1	10.8	11.7	...	11.5	11.7
Dope film, cellulose nitrate	5.52	1.4	2.0	2.8	4.1	5.0	6.3	6.8
Gas-cell fabric, light-weight	4.93	17.1	30.3	48.8	71.1	87.6	95.7	98.5
Same as above paraffined on both sides	5.63	7.3	16.5	29.2	45.0	58.8	62.3	...
Gas-cell fabric, heavy-weight	6.35	11.0	20.4	33.0	44.9	50.8	63.4	70.9
Same as above paraffined on both sides	6.95	4.9	11.0	19.6	31.1	40.2	45.0	52.2

Table 4—Gain in Weight of the Fabrics Used on an Airship (GZ-1 Type) at Various Humidities

	Weight at 65% relative humidity and 21° C Lb.	94% relative humidity 1 Day Lb.	1 Week Lb.	4 Weeks Lb.	97% relative humidity 1 Day Lb.	1 Week Lb.	4 Weeks Lb.	100% relative humidity 1 Day Lb.	1 Week Lb.	4 Weeks Lb.
Outer cover	11,680	526	526	526	748	853	853	1,016	1,834	3,247
Gas-cell fabric, light-weight	11,163	513	1,764	2,891	737	2,735	5,570	815	3,260	6,955
Gas-cell fabric, heavy-weight	7,171	280	925	1,556	337	1,241	2,868	351	1,406	3,227
Total	30,014	1,319	3,215	4,973	1,822	4,829	9,291	2,182	6,500	13,429

hours with uncoated cloths and doped fabrics when they are exposed in relative humidities from 0 to 86 per cent. The same is true at a relative humidity of 94 per cent after 3 days and of 97 per cent after 7 days. The absorption of moisture continues over long periods at 100 per cent relative humidity and is shown in Table 3 for the various materials. The gas-cell fabrics require considerably longer periods of exposure than the other aircraft fabrics to reach equilibrium at relative humidities below 100 per cent. In service paraffin is always applied to the surfaces of the gas-cell fabrics to retard the rate of absorption. The effect of the paraffin on the absorption of moisture is shown in Table 3. The gain in weight is based on the weight of the gas-cell fabric without paraffin in order to make the data comparable.

These data for the absorption of moisture by aeronautical textiles offer considerable material for speculation as to possible improvement of the present products. Cellulose nitrate dope, which is the type commonly in use on airplanes, is exceedingly inflammable, and a fire-resistant dope to replace it is highly desirable. Cellulose acetate dope has been proposed for this purpose, but it has been stated that airplane wings doped with cellulose acetate lose their tautness in humid weather, particularly under conditions of fog. The fact that cellulose acetate is markedly hygroscopic at 100 per cent relative humidity (Table 2) is in accord with this observation. However, it is our understanding that the much safer cellulose acetate dope is the only kind used on service planes in France. We hope to present data later on the effect of high relative humidities on the tautness of fabrics coated with cellulose acetate dope.

Values for gain in weight after 1 day, 1 week and 4 weeks due to the absorption of moisture by the coated fabrics that are used on an airship such as the "Macon" have been calculated on the basis of the data obtained in this investigation and are presented in Table 4. The data for the light-weight gas-cell fabric are on the basis

of the results with a sample containing 0.7 ounce per square yard paraffin or 14 per cent by weight; those for the heavy-weight fabric are on the basis of the results with a sample containing 0.6 ounce per square yard paraffin or 9.5 per cent by weight. It will be observed that the gain in weight in 1 day at the high humidities is approximately 1 ton; after 1 week it varies from 1.5 to 3.25 tons and after 4 weeks from 2.5 to 6.75 tons. The fact that the maximum value noted in Table 4 is higher than that found by Bird for the R. 101 is because of the larger size of the ship as well as the greater hygroscopicity of the fabrics.

DISCUSSION

Mr. Robert M. Moore: What material are the gas bags made of, cotton or silk?

Mr. Kline: The cloth is cotton. In the case of the gas-cell fabric, it is an unmercerized material and, as I said, it is, of course, treated with the gelatin material and the plasticizer is glycerin, which are the chief offenders as far as taking up moisture is concerned.

President Rose: Are there any other questions that anyone would like to ask Dr. Kline?

Mr. Lee Smith: I should like to ask about the plasticizers used in the cellulose acetate. Do you know about those?

Mr. Kline: In one of the materials that we use there is, as I recall, some dibutyl tartrate, possibly some dibutyl phthalate.

The other sample we studied came from the "Los Angeles," and was some of the original material put on in Germany on the outer covering. I do not know what the plasticizer was.

Mr. Smith: Do you know about the percentages of these?

Mr. Kline: I don't have the information at hand. I think for the total dope there was about three per cent plasticizer present——

Mr. Smith: That is in liquid form?

Mr. Kline: Yes, that is in the liquid form.

President Rose: Are there any further questions?

Dr. Walter M. Scott: I should like to ask Dr. Kline whether any experiments have been made with an airplane doped with other cellulose products, that is, like the ethers, for example. Do you know?

Mr. Kline: There haven't been any published results so far as I have been able to ascertain regarding the cellulose ethers or the esters of the higher fatty acids.

President Rose: Are there any further questions?

Mr. Paul A. Endriss: I should like to ask if these treatments for these dopes actually make the fabric waterproof or water-repellant?

Mr. Kline: Well, the fabrics are waterproof to a degree. That is, they are still capable of taking up the moisture, but the nitrate material will retain its tautness even on exposure to water. But, as I said in my talk, it has been shown plainly that the acetate material does lose its tautness in the presence of water.

Mr. Endriss: Does the fabric become rather stiff under this treatment or does it have a pliability of, let us say, something like a raincoat material?

Mr. Kline: Of course, the samples that we were using were suspended from the bottom. They were not tacked on an experimental panel. We hope to present results later which will show the effect of moisture absorption on the tautness of the doped fabric.

President Rose: Are there any other questions? If not, we will proceed to the next paper on our program, which is a subject of very great interest to all of us, "Fading of Dyeings in Radiation of Different Intensities," by W. D. Appel, of the Bureau of Standards. Mr. Appel.

. . . Mr. Appel presented his prepared paper, which will be published at a later date . . . (Applause.)

President Rose: We will now pass to the next paper, "Various Applications of Fluorescence Analysis," by A. E. Sampson, of the Calco Chemical Company.

Mr. Sampson: Before I start my talk, I am going to take the privilege of passing this book among you so that you can look over some of the lumenograms, which I think will help you to follow what I have to stay, and bring out quite a number of the points I wish to stress.

. . . Mr. Sampson then presented his prepared paper . . . (Applause.)

STANDARD SILK SAMPLES

There have been prepared, under the direction of the Sub-Committee on Fastness of Dyed Silk, standard dyed silk fabrics to represent four classes of fastness to washing—namely, Class I, Class II, Class III and Class IV. These standards have been carefully dyed with the dyestuffs and according to the dyeing methods recommended in the 1931 Year Book.

The A. A. T. C. C. is prepared to furnish sets of these washing standards for a nominal charge which will cover the cost of preparation. It will be possible to accurately grade the fastness by comparing it with the standards after subjection to the standard washing tests approved by this Association. All inquiries concerning these Silk Washing Standards may be addressed to the Chairman of the Research Committee.

Louis A. Olney,
Lowell Textile Institute,
Lowell, Massachusetts.

Proceedings of the American Association of Textile Chemists and Colorists

Various Applications of

Fluorescence Analysis*

By **A. E. SAMPSON**
Calco Chemical Co., Inc.

FOR the past decade the literature has contained occasional, and in recent years, increasing references on the use of Fluorescence in identification and analytical work.

Unquestionably, many of you here assembled have given recognition to these articles and in our official organ, THE AMERICAN DYESTUFF REPORTER, we have had frequent reference to work done in textile fields either as such, or on the effect of ultra-violet light on various dyes and materials.

Many years of association with the problems of the color chemist leads me to believe this method of analysis has a limited but distinct and valuable function; and in view of recent developments in ultra-violet light sources, and a better understanding of the qualitative and quantitative possibilities of the microscope and the spectroscope, it appears the time is ripe for a concerted action on the part of interested parties.

It is doubtful if any appreciable number here have attempted to utilize such an assay method in color and textile work, and it is my sole purpose today to attempt to interest mainly the uninitiated in the field of fluorescence analysis and stimulate investigative work which will make available simpler fluorescence analysis procedures adapted to meet the special needs of the textile chemist and colorist.

In the brief half-hour allotted it is difficult to do justice to this broad and rather intricate subject. It was my hope to bring here actual displays of the fluorescence effects obtainable but the time allotted would not permit this as sample displays are rather time-consuming. And the best procedure appears to be to sketch out to you the basic principles of fluorescence analysis, and the usual methods of procedure, cite a few instances of successful application and suggest some possibilities where future application may be of service.

The underlying principle with which we are concerned is "Light" and that, to serve our purpose, should be considered not as consisting of those wavelengths apparent to the human eye but as energy radiated in the form of electro magnetic radiations, or wavelengths.

Such wavelengths vary appreciably and are commonly measured in terms of Angstrom Units (A^0), each being 10^{-8} centimeters. The entire range covering a wavelength of 1/10,000 A^0 — 10^{17} A^0.

The vibrations with which we are concerned are from 136 A^0 to 4000 A^0, with special reference to 2800 A^0-4000 A^0, and the initial range is intermediate between the X-ray field and the solar or "white light" scale. That is, the Angstrom Units of value in fluorescence analysis overlap the violet rays of the solar or "white light" division which are the shortest rays visible to the human eye and are intermediate in physical properties between the X-rays and solar rays.

The second principle to be considered is "Luminescence" and that requires some clarifying explanation to correct the general misunderstandings of the term as we shall use it.

If we view an Eosin solution in water or an Eosin dyeing in silk in reflected daylight everyone here would say it was fluorescent. And examination of Lithopone under similar conditions would be termed non-fluorescent.

Should we view these in a darkened room under a U. V. lamp our decision would be the same. But if we view these under conditions where the exposure is confined to wavelengths around 2800-4000 A^0 we find both show fluorescence or luminescence. And we therefore define luminescence as the ability of substances, when exposed to light sources of the proper range, to fluoresce, or give off light which may or may not be visible to the naked eye. That is this term fluorescence is that physical sensation of seeing a characteristic color, or halo, or glow similar to what we ordinarily associate with phosphorescence.

The action is, however, far different, as our common conception of phosphorescence should be correctly termed chemi-luminescence, as it is usually the effect of oxidation action on phosphoric bodies. Whereas true luminescence, or as we will term it, fluorescence, it attributed to the ability of many substances to absorb the wavelengths of the ultra-violet range and emit or re-emit them as such

*Presented at Annual Meeting, December 8th, 1934.

or in the form of wavelengths of higher Angstrom value. This theory hinges upon atomic structure, and is proven mathematically by the quantum theory, that the energy of the short wavelengths is absorbed with subsequent displacement of the electrons from their orbits, thereby setting up an unstable condition of momentary character and when the electron returns to its original position radiation emission, or fluorescence occurs.

In brief the principles involved are, upon recapitulation:

Light
Wavelength
Radiation Emission

and to make these principles workable for fluorescence analysis we need:

1. A light source of 136-4000 A°.
2. An arrangement whereby materials exposed to this light source may be viewed and their characteristics of radiation emission, or fluorescence observed.

To illustrate the apparatus involved I am going to pass among you the very simplest form of fluorescence analyzer, the so-called Cellaphane. This simple, portable, instrument is only adapted for the most elementary types of analysis and observation, and consists of a folding observation box equipped with a glass filter which excludes visible light and allows ultra-violet rays to pass. Substances are placed therein for examination and the observation made in strong daylight before the open window or in direct sunlight. If observed by the direct sunlight method the double filter is used. A special lamp is available of the U. V. type that operates on 110-220 v. circuits, or a U. V. exposure lamp may be used.

The usual lamp employed is an evacuated, fused quartz tube with mercury containing receptacles at either end each in contact with cemented metallic leads attached to a 110-220 v. circuit. Contact being made by tilting the tube until the mercury flows and contacts, effecting a short circuit, whereby the mercury boils and fills the tube with its vapor. At first the light is bluish and erratic but attains its maximum intensity after a few moments.

Such lamps are enclosed and suspended in a black, velvet-lined cabinet, or dark room, with an observation chamber below the lamp for the examination of samples. The light from the lamp passes through various glass filters such as Wood's Glass, a nickel oxide flux, that absorbs the visible spectrum but is transparent to the long end of the ultra-violet region.

Analysis is carried out by two general procedures:

A. Visual—Observation by the eye alone.

B. Photometric—Or the utilization of the photometer.

In each of these two methods the procedure may be anyone or a combination of either with the microscope, polarizer, or spectroscope.

The analysis may be either qualitative or quantitative, with the former unquestionably its broadest and most serviceable application. Identification is usually made by comparing with known materials, or the utilization of the results of prior experience, and is carried out at a range of concentrations, in various solvents and at pH intervals.

Quantitative assay is extremely accurate in many cases where it is desired to determine traces of materials, such as arsenic, preservatives, etc., and commonly estimated by comparing with prepared standards, graph plots, titrations or colorimetric estimation. For this type of work careful check on the intensity of the light source is necessary as every emission varient is not uniform throughout the spectral range. This checking may be accomplished through photo-electric cell arrangements or by some such simple test as the fading of Methylene Blue solutions in acetone, the phototropic effect of various dyes on the decomposition of carbon tetrachloride into chlorine and tetrachlorethane and subsequent estimation of the chlorine liberated by Potassium Iodide colorimetrically.

Either qualitative or quantitative analytical methods may be applied to all states of matter, gases, liquids, or solids. And the general practice is to subject these for examination in non-fluorescing glass or quartz dishes, flasks, or Petrie dishes, or in non-fluorescent white filter paper. Then direct the rays of the light so they fall directly on the substance examined and without influence of any reflected rays from the sides of the containers.

The assay of gases is rarely used and is quite difficult to handle by reason of observation errors due to the appreciable influence of the observations by vapor pressure and vapor density factors.

Liquids may be analyzed as such or in solution of various solvents or by examination of the capillarity tests made on non-fluorescing white filter paper strips, and subsequent examination and observation under different pH conditions and at varying concentrations.

Solids yield the most satisfactory results when examined as such and then breaking the solid and observing the fresh fracture.

1. As such
2. Spotted with dilute acid.
3. Spotted with dilute alkali.
4. Pulverizing and examining as a powder by:
   A. Shaking up in a non-fluorescing liquid
   B. Blowing out on damp non-fluorescing white filter paper
   C. Examining its solution as discussed under liquids.

The foregoing has unquestionably been tedious, but essential in that I hope you now have a background of the principles and *modus operandi* concerned. And I trust you have also gathered there is much more to this

than simply placing the material in the Callophane and writing down the result.

If my supposition is correct let us turn to the possibilities of fluorescence analysis in the fields of endeavor you gentlemen represent.

COTTON

Various fungi, bacteria and molds show varied fluorescence effects of bright color if exposed in the slightly dampened state. Mold fungi usually show violet tones which are easily recognizable and much valuable information may be secured as to the source of damage from these sources, the identifying of the offending parasite, and its elimination.

Improperly boiled-off or diastafored goods leave varying amounts of wood sugars, starches or cellular material behind and interesting information can be obtained either by observation of the materials as such or by treating with caustic soda and observing the character of the green fluorescence.

In the case of finishes it is often necessary to know if preservatives are present and the more common ones are recognizable, as:

Boric acid gives a yellow brown.
Benzoic acid a blue.
Salicylic acid a violet-fluorescence.

The sodium salts are more fluorescent than the free acids and sodium salicylate is detachable 1 part in 20,000-25,000.

Pigments can be easily identified by comparison with known standards.

Chalk—Medium to reddish-brown.
Kaolin—Red violet.
Talc—Dull violet.
Titanium White—Deep reddish-blue.
Lithopone—Dull bluish-green.
Ultramarine—Dark blue violet.
Magnesium Carbonate—Violet.

Waxes show characteristic investigation:

Ceresine—Whitish fluorescence.
Yellow Ceresine—Dull sandy brown.
Canauba—Bright yellow.
Beeswax—Brownish yellow.

Phenol type resins show little or no fluorescence and Urea Resins give positive fluorescence sufficient to provide ready means of identification.

Traces of free sulfuric acid are readily discernible by the use of quinone and with modifications the method can unquestionably be adapted for the estimation of sulfides and hydrogen sulfide.

There should be a possibility of fluorescence analysis being utilized in the estimation of traces of copper and manganese and eliminate the present rather tedious and possibly not too accurate methods. Some of the more interesting fluorescence effects are:

Aluminum Oxide—Rose.
Cuprous Nitrate—Violet.
Free Sulfur—Yellow brown.
Cupric Chloride—Light green.
Manganese Formate—Bluish.

Interesting observations can be made in determining the level dyeing qualities of a dye as there are a considerable range of colors which fluoresce sufficiently to indicate their evenness of distribution by observing the uniformity of the fluorescence over a definite area.

Damaged goods are extremely difficult to trace in regard to the offending course. Careful examination under the light gives many leads on oxycellulose, scruff marks, oil, old or new cotton fibers, metallic resists, lime spots and water marks or stains.

SILK

The character of weighting agents, such as lead or tin, have a distinctive fluorescence and sumac, glucose and similar loading agents are detectable.

Silk is especially well suited for showing the fluorescence of dyes on the fiber as great brilliancy is obtainable and the readings made with ease.

WOOL

Mechanical and chemical damage is readily assayed, by immersing wools in a boiling 1% solution of Calcomine Red 10B and washing. Undamaged wools show no change, mechanical damage pink, alkali damage yellowish-pink and acid deterioration bluish-pink.

Various stains yield easily discernible effects. Urine spots show yellowish fluorescence, albumin whitish and blood orange fluorescence in sulfuric acid which turns to brilliant carmine when thrown alkaline with ammonia. Creatine and amino acid display bluish effects.

The percentage of oil in yarns, goods or stocks may be accurately estimated, and considerable information secured on their identification by comparing with prepared standards.

Genuine camels' hair has a reddish dull brown fluorescence and is readily distinguished from dyed imitation wools.

LEATHER

The degree of penetration of tanning agents is easily noted and the identification quite positive of the principle used.

	Acid	*Alkali*
Gambier	Bright Violet	Green
Oak	Violet	Violet
Sumach	Purple	Dark Purple
Chestnut	Bright Violet	Dark Brown
Catechu	Light Violet	Brown

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Fourteenth Annual Banquet

Saturday Evening, December 8, 1934

The Banquet Session of the Fourteenth Annual Meeting of the American Association of Textile Chemists and Colorists was held in the Ballroom of the Hotel New Yorker, New York City, Mr. P. J. Wood presiding as Toastmaster.

Mr. Ephraim Freedman: My Friends: As Chairman of the New York Section of the American Association of Textile Chemists and Colorists, it is my pleasant privilege to bid you welcome.

It is extremely gratifying to see this large ballroom filled to overflowing with so large and amiable an attendance. Many states in the Union and all of the Sections of our Association are ably represented. Many members have traveled long distances to get here.

Among them I would like to mention Mr. R. S. Wheeler, who has come up from Chickamauga, Georgia. Mr. Witold Olpenski from Cowansville, Quebec, Alfred Cecil Goodings, Toronto, Canada, Paul Boler, Savannah, Georgia, Dr. Pratt Gordon of Montreal, Kurt Richter of Elizabethton, Tennessee, Frank A. Love of Elizabethton, Tennessee, and G. R. Kremerz, who has traveled all the way from Kenosha, Wisconsin.

Undoubtedly there are a number of others who have traveled great distances: from Chicago, Cincinnati and other places, and this vast array of textile chemists and colorists and their friends here this evening is undeniable evidence of the heartfelt interest taken in the work of our Association, and certainly speaks well for the future.

Our committee has planned rather a full evening for you and so without further ado I am going to call upon our Toastmaster, our dearest beloved P. J. Wood. (Applause.)

Toastmaster P. J. Wood: Mr. Chairman of the New York Section, Fair Ladies, and Fellow Members: It is a pleasure for me to be here, to look into your faces, believe me, and before I introduce the speakers of the evening I would like to make one complimentary remark, and that is with regard to your singing: I enjoyed it. I never heard such singing. (Laughter).

Man goeth forth in the morn of his existence like the angler, but with what manner of fish the stream shall be filled when he draws in his line at the end of life's day he knoweth not.

Herbert Spencer said that "life is a combination of fortuitous circumstances," which is only another way of saying that life is one thing after another.

And what combinations we do get! It is always the tall man who gets the short woman; it is the short man who gets the tall woman and the children get the measels. (Laughter).

It is such a combination of fortuitous circumstances that brings me to this table tonight and furnishes me with an opportunity to make an experiment in toastmastering which occurred to me the other night as I was thinking of this occasion. I would like you to forbear with me. So far as I know this is the first time and probably will be the last time it has been tried on this or any other air.

On thinking over the matter of toastmastering very seriously, and realizing the agonies that many toastmasters go through because of the solo nature of the performance, it occurred to me that we might have a much better plan to follow: that is to have the audience take part in the performance. I propose to make this a cooperative effort. In order to do this we will employ what is known on the stage as the "stooge."

Some of you may not know what a "Stooge" is. I was unable to find it in the dictionary so I can't tell you if you don't know, but it depends on what the Greeks might have called strophe antiphone, that is, the one taking one part called the strophe and the others replying with the antiphone. So, if you don't mind, we will try it and we will have a little rehearsal before we start.

As the strophe I propose to use the words "Am I right, boys?" and you will reply—now get these words, this is your part: "Sure, you are right"—with the rhythm, "Sure, you are right," and I want you to do it with force, with vehemence, with eclat and with aplomb.

I will enunciate the strophe. You will take the antiphone. "Am I right, boys?"

Members: Sure, you are right.

Toastmaster Wood: You bet I'm right. (Laughter).

Now I don't know whether you like this or not. I think I will; it will probably relieve me a little bit.

The first speaker on our program as is very fitting, is the President of our Association. I think you will agree with me when I say that he is the best president the Association has had in four years.

Am I right, boys?

Voices: Sure, you are right.

Toastmaster Wood: You bet I'm right.

It is a great pleasure for me to introduce—not introduce, but present—Doctor Rose. (Applause).

Remarks by

ROBERT E. ROSE

President Rose: Mr. Toastmaster, Ladies and Gentlemen: I wish first of all to thank those of you who have the right to vote in the Association for re-electing me president. That is the highest compliment you can pay me in judgment of what I have done last year, and I hope it is deserved.

I than have a duty which is a very pleasant one, a very appropriate one, and one that I fulfill with a great deal of delight, and that is to thank the officers and the heads of committees of the New York Section for making this meeting the most successful, in point of numbers, and I feel safe in saying the most successful in point of quality of brain power that we have ever had.

The next meeting will be in entirely different surroundings if the present plans are carried out, but they are not matured yet, so I cannot tell you positively where the meeting will be held. There was some thought that it might be in Philadelphia, and now, since the South is very anxious to be our hosts, and we are quite anxious to be the guests of the South it seems as if Philadelphia may withdraw in favor of Chattanooga. That is a matter which will come before the Council, but if I am to act as a prophet I believe that our next meeting will be in Chattanooga, Tennessee. (Applause).

Gentlemen, this Association is fourteen years old, if you look at the program of this banquet, but it actually is only thirteen years old because we were born at a banquet apparently. From the small number of charter members who were present then, with those who became associated with them, we have grown to an organization of over 1300 members, and we have a record which I am willing to maintain is unique among associations of our kind. We have gone through the past five years without a drop in membership and at present we have a larger membership than we have ever had before. I don't think anything speaks more eloquently of the fact that we can call ourselves a successful association as far as we have gone.

I should like to ask the question "Why are we successful?" I can answer that by saying "Because we have succeeded in doing in some measure what we set out to do"—and that which we set out to do you will find on our program for the evening, which states that we intended to promote increase of knowledge of the application of dyes and chemicals in the textile industry; to encourage in a practical way research work on chemical processes and materials of importance to the textile industry; third, to establish for the members channels by which the interchange of professional knowledge among them may be increased.

Of those three it is needless to say that we have accomplished a very great deal in finding and making available new knowledge of importance to the textile industry. The very fact that we have associated has enabled us to do things that we individually never could possibly do and

this has given each member advantages. Those advantages are what has made our membership grow.

In addition we have done what I think is the most important thing of all. It is really included in this last object; we have brought ourselves together in such a way that we have become friends and that has counted for more than anything else. It is next to impossible to let a friend go on his way to trouble when by a kindly word, spoken out of a meritorious experience, you can save him from that trouble. That means that by coming together in this Association we have helped each other. I should like to emphasize this fact: that every time we help each other we help those for whom we work because after all, we are overwhelmingly those who are paid a salary to work for somebody else. We get our joy in working for ourselves, but we work for somebody else too. In that respect I think there is a great deal that we might do in promoting an understanding of how valuable this association among our members is to those whose advantages are served by the best possible freedom of exchange of ideas among those who are members.

I will not take any more time now to emphasize what might be emphasized a great deal more strongly, but I will say this: That it seems to me, looking back and then turning our back on the past and looking into the future, we may face that future with that high hope, that high belief in our destiny which knows no fear; and that we can say in some way we are justified in advancing fearlessly, because by our efforts in the short time we have been active we have decreased that great ignorance, that unmerited suspicion which is, after all, the greatest stumbling block of the human race. (Applause).

Toastmaster Wood: Doctor Rose, on behalf of the membership of this Association I want to thank you for those inspiring words and I bespeak for Doctor Rose, who is at once the past president and the incoming president of this Association, the cooperation of every member in attaining these ideals which are set before us.

Let us at least cooperate with him to the extent of the quack doctor's assistant of whom I heard recently: This quack doctor was selling some sort of a nostrum which he said would make people live forever. "Why," he said, "Look at me. I am over three hundred years old and not an ache or pain in me; I am hale and hearty." Somebody sneaked around the outside of the crowd and asked his assistant "Is he really three hundred years old?"

"Oh, I don't know," he said, "I have only worked for him a hundred years." (Laughter).

It seems all of our speakers need no introduction tonight so far, so I fail to see why we had to have a toastmaster, myself. We all know the next speaker; we all like him; we have all known him throughout the entire life of the Association, and a great many of you have known him as students for a great many years before that.

While he is President Emeritus of this Association he has been for 38 years director of the Department of Chemistry and Dyeing in the Lowell Textile Institute.

Our first President, Professor Olney! (Applause).

Remarks by

LOUIS. A. OLNEY

Prof. Louis A. Olney: Mr. Toastmaster, Honored Guests, and Fellow Members. It is with a mingled feeling of satisfaction and apprehension that I come before you this evening—satisfaction because it is always a pleasure to attend these meetings, greet so many of my old friends, observe the growth of our Association and renew my enthusiasm for its future. On the other hand, there is a feeling of apprehension because my perennial appearance at this time and on this occasion may lead you to believe that it involves presumption upon my part. At this time of the year I always have to meet a rather peculiar situation. Of course it would be out of place for me to decline to speak before I had been invited and yet on the other hand I find that the program always appears with my name on it, without any previous consultation with me and without any opportunity on my part to refuse. So here I am again, and I presume we will all have to make the best of it.

A few days ago, I am told, a truck loaded with dyed silks was passing through the streets of Paterson. As trucks sometimes do, it stopped rather suddenly and this so disturbed the load that a bolt of silk cloth rolled out of the back, broke open, and the beautifully dyed cloth went rolling across the street in the mud. It was on one of the prominent streets of Paterson and naturally a crowd soon gathered and began to sympathize with the truck driver. One man stepped out from the crowd and said, "Look here, my man. We are all very sorry for you. I suppose you will have to pay your employer for this damage. Here is fifty cents. Put it in your hat; pass your hat around through the crowd, and I am sure they will help you out."

The crowd turned out to be very sympathetic. People dropped in quarters and half dollars and two who seemed to be unduly overcome put in bills. Later on as the driver stood looking at his hat the bottom of which was well covered with money, he said to a bystander, "I always knew my employer was a wonderful man, but until now I didn't know how clever he was."

The bystander said, "How is that?"

"Well, the man that put in the first fifty cents is my employer." (Laughter).

"By the way," said the man, "who is your employer?"

"Why, P. J. Wood." (Laughter).

I have been asked to say a few words in regard to our Year Book. The first edition came out ten years ago in 1923, and the best we could do, and that with considerable difficulty, was to bring it *up* to somewhere around 140 pages. We had to work just as hard on the last Year Book to keep it *down* to 500 pages.

Some may ask when our Year Book is supposed to come out. I don't know whether it ever came out twice at the same time, but naturally as it covers the work of the association during the previous year the 1934 Year Book for instance will not be due until some time in 1935. If we have good luck you will have it in your hands by, we will say, the first of May.

I am glad to have this opportunity to say just a word of commendation for those who really make the Year Book possible. You can well imagine that it is rather an expensive undertaking and it would be impossible to put out the book at all if it were not for the aid of those who advertise and I want to tell them all—and there are many of them here tonight—that their help is greatly appreciated. We certainly hope that they will not fail us in the future because I know every member of the association wishes the Book continued and from what we hear they make very good use of it.

There is one very congenial face that is missing at the head table tonight, a man who was very enthusiastic in regard to the formation of this society and has always worked hard in its support. I refer to Doctor E. H. Killheffer, our second president, (applause) who at this time is enjoying a well earned vacation and rest under the sunny skies of Florida. I am sure that everyone will join me as I propose that the chairman of our program committee and the secretary of our Association send him a letter expressing the wishes of us all for his health and prosperity. (Applause).

We have had an unusually well arranged technical program at this meeting, and one of the strangest things is that it went off on time. Doctor Draves, who arranged the technical program, was very largely responsible for its promptness. As I noticed today how like clockwork it was being followed, I recalled a meeting of the American Chemical Society that was held about twelve years ago right here in New York, up at the University of the City of New York.

They had a rather long program arranged for the afternoon; there were to be four speakers and each was to be allowed half an hour; they were going to begin promptly at three o'clock and be through at five. For some reason or other which never was explained, the meeting was half an hour late in starting. The first speaker took three-quarters of an hour; the next one almost as much time; and then the third speaker, a prominent chemist, read for over an hour from a manuscript which apparently was poorly typed. The fourth and last speaker was my friend, Professor Bancroft from Cornell. His subject was "Catalysis"; he got up, and in that crisp manner of his said, "Gentlemen, catalysis is, as you know, a speeding up process and I am sure that the one who arranged this program made a mistake. He

should have put my paper at the beginning and not at the end."

I am sure the speakers who follow me, will not think that what I have said refers in any way to this evening's program and that they will take all the time that may wish.

There is an old saying that "if you would learn let the other fellow do the talking; you will make no headway listening to yourself." As I look over this program and note the galaxy of speakers to follow I am sure that I want to listen and have no desire whatever to continue talking. However, before I close my remarks, I would like to say that when I first looked around here this evening I at first thought I was attending an alumni meeting of the Lowell Textile Institute. I wish to express my best wishes to every one here and express them doubly to all of the young men (some of them however, don't look quite as young as they once did) who were formerly students at Lowell. (Applause).

Toastmaster Wood: I will ask Mr. Arthur Thompson to say a few words at this time. Mr. Thompson is not on the program.

Remarks by

ARTHUR THOMPSON, JR.

Mr. Arthur Thompson: Mr. Toastmaster, Mr. Chairman, Members of the Association and most charming young ladies: Being called upon rather unexpectedly, I am obliged to be reminded of something and I find myself reminded of the busy purchasing agent who died and went to Heaven. They don't ordinarily go there, but this one did. He was getting himself situated in a very comfortable easy chair, when he heard his name being paged. The thought had just gone through his mind "Well, now I can take the rest of my life easy."

This page angel was calling "Mr. Jones." Mr. Jones couldn't imagine his being paged up there in Heaven. He said, "What in the devil do you want now?"

"They are wanting you on the ouija board."

The reason I am on my feet tonight is to return the compliments that Professor Olney paid to the alumni of Lowell Textile School. I say "The Lowell Textile School" Professor, because that is what we older boys know it as.

I can recall in the years 1917 and 1918 when the Association that we are members of was being conceived by Professor Olney. I don't think he had any idea that in this short space of time the organization would be so far reaching, that we would have such large and successful meetings in the South and West and all over the country. Professor Olney, if my glass were not empty I would suggest a toast to your good health and prosperity and fortune in the years to come at the Lowell Textile Institute.

I think one of the finest things that a man engaged in the teaching profession can experience is a knowledge that his work has been appreciated. The students that he has helped through school in one way or another really appreciate the work that he has done for them, because while they are in school they do not appreciate the work of their instructors. After they get out they surely do and I am going to call upon the alumni of the Lowell Textile Institute and ask them to rise and show Professor Olney how much he has done for them since they have been out.

. . . A great many of those present arose and applauded. . . .

Prof. Olney: I just want to say that I appreciate this expression of good-will very much indeed and I shall remember it as long as I live, which I trust will be many years.

Toastmaster Wood: I feel called upon to rise and defend the fair name of our city of Paterson. (Laughter). It is a very much maligned town, you know. It has been my home for the biggest part of my life, and while I knew that silk took a drop once in a while I never knew any printer or dyer to benefit by it. (Laughter). However, Professor, the suggestion is a good one. (Laughter).

Our next speaker is a man who has been prominent in the financial field for a great many years. He has written articles and opinions for many of the financial papers. He is an economist. His job is to publish opinions. It isn't always our job to agree with them. You know, opinions are really a matter of comparison, after all, aren't them? Like the Scotchman who went to the bridge party, and when he got back his neighbor asked him, "And how did you make out at the bridge party, Sandy," he said. "Well, I didn't do so well, but I got the second prize."

"What was the second prize?"

"Well, you see," he says, "I was allowed to kiss Mrs. McPherson."

"Oh, she's a fine lady, and that was fine. What was the first prize?"

"Ten cents." (Laughter).

Which only goes to show that these opinions are a matter of comparison.

So I am going to ask the next speaker to just give us his opinions.

Mr. Q. Forrest Walker, who is the economist with R. H. Macy and Company! (Applause).

Mr. Q. Forrest Walker: Mr. Toastmaster, Ladies and Gentlemen: I have come tonight to talk to you upon what I conceive to be one of the critical and important problems of the hour. I refer to the great experiment in business regulation under codes.

Proceedings of the American Association of Textile Chemists and Colorists

The Experiment in Business Regulation by Codes[1]

By Q. FORREST WALKER
R. H. Macy & Co.

STRINGENT regulation of industry and trade is not a new social phenomenon. It is found in varied forms in ancient and medieval economic life. But it flourishes particularly in the age of mercantilism. In seventeenth century France, Colbert sought to solve the problems of economic depression by comprehensive codification of important industries, but the most interesting experiments in economic control are found in English economic history.

Parliament early directed its attention to national control and uniform regulation of the cloth trade. It not only regulated the conditions of labor, but it prescribed in minute detail the manufacturing processes, the kinds of machinery to be used, the qualities of materials and the forms of the finished products. A vast multitude of laws crowded the statute books. In the seventeenth century, it was said: "There are now many laws in force concerning the making of cloth, which for their number and contradiction do perplex and entangle the makers of cloth, and make it hard to be discerned what the law is in many particulars."[2]

To enforce these laws, Parliament created officials known as aulnagers. It was their duty to inspect the cloth. They were enjoined particularly to condemn cloth with poor yarn, bad dyes, and short measurements. If the cloth passed inspection, they were required to affix their seals. The aulnage soon became a "racket". The manufacturers found that they could buy the seals by the bushelful and affix them without any inspection. The system broke down and was succeeded by a new group of officials known as searchers who had power to enter workshops and seal cloths, but the trade in searchers' seals became brisk enough to warrant a special market. Finally, the whole scheme of minute regulation and standardization collapsed and the laws were repealed. Parliament concluded that the markets of the world required all kinds and qualities of cloth and that the natural forces of competition were a sufficient corrective for those manufacturers who cheated their trade. In our codes of fair competition under the National Industrial Recovery Act we have revived in modern form many of the fallacies and foibles of the age of mercantilism.

When this legislation was before the Senate, it was argued that the main purpose was to rationalize competition and "put it on the basis of efficiency rather than on the basis of exploitation of labor." With reference to other purposes, Senator Wagner said:

"There are some other desirable powers that ought to be granted in addition to the right to agree on hours and wages. These include suppression of fraudulent practices, false advertising and the like. Then there are additional benefits such as the interchange of information and the promulgation of research. . . ."

At another point in the debate on the bill he said:

"I do not mean to imply that the pending legislation contemplates price fixing."

There has never been any important disagreement with the broad basic principle that competition based on long hours, starvation wages and child labor has no place in an enlightened economy. It is true that there are difficulties in the application of minimum wages and maximum hours to an infinite variety of enterprise scattered over a large area and there has been controversy over the interpretation of the other labor provisions. From the standpoint of the consumer, however, the most important feature of this legislation is the interpretation which has been given to the term "fair competition" in the drafting of codes of fair competition.

You may be surprised at the minute regulations set up in many codes. It is presumably "unfair competition" to manufacture and sell clay flower pots except in the sizes set forth in the Code for the Earthenware Manufacturing Industry. Under the Macaroni Code, the manufacturer may not wrap his product in colored paper or containers which have a yellow color of deeper shade than the actual egg yolk content of the product and he must not use any artificial coloring matter which will tend to indicate a false egg yolk content for his product. Under the Broom Code, any broom which contains any particle,

[1] An address given before the 14th annual banquet, December 8, 1934.
[2] E. Lipson: Economic History of England, Vol. III, p. 319.

piece or part of grass, straw, or fiber which is not broom corn, must have a separate label one inch away from the regular label, in 10 point black type on white paper, bearing the legend: "This broom contains (here give the common trade name of the substitute)—a substitute for broom corn." Among other restrictions, the Corset Code regulates the number of items which may be packed in a box. It is true that there are some very simple codes, but the vast line-up from abrasives to wooden plugs will yield every kind and variety of hobbles for competition, both fair and unfair.

We need not be greatly concerned about these extreme efforts to reform and regulate the incidental and unimportant phases of competition. The really serious dangers in our codes are the numerous devices for direct and indirect price fixing and control. Our code makers have imposed many arbitrary and uneconomic restraints upon the normal processes of price making. Wide disparity in relative prices has long been recognized as a potent cause of our economic troubles, yet our codes in their conception and operation are largely systems for increasing and intensifying these price disparities. We have set up an intricate web of price protection for our internal trade which is analogus to series of internal tariffs. These price control systems obstruct the free flow of trade within the country and foster special privilege. Hence, our price structure is slow to adjust itself to our national income and business recovery has been seriously retarded.

The National Industrial Recovery Act sets up no standard of interpretation for "fair competition." It does not define the meaning of "unfair competition." The legal and generally accepted meaning of these terms has never hitherto been stretched to cover the wholly ordinary and natural fluctuations of prices under a competitive economy—fluctuations which are the inevitable consequence of the continual adjustment of demand and supply. Code sponsors have sought and obtained price controls by pleading that they were necessary to prevent "destructive price cutting." It has been generally held that local price discriminations for the purpose of destroying competition and establishing monopoly are unlawful, but this is not the type of "destructive price cutting" which the code makers have had in mind. If one group within an industry has lower prices than another group, the higher price group believes that the lower price group engages in "destructive price cutting." In short, the term is chiefly important because it denotes the objections of one group to the prices of another group. Price fixing and control have been sought principally as a means of eliminating the natural forces of competition.

No very careful consideration has been given to economic aspects of price fixing. Code makers invariably overlooked the fact that price is simply the monetary expression of the meeting point of demand and supply. Under any system of free and democratic government, in the absence of monopoly, neither demand nor supply can be effectively regulated and controlled. If the forces which make prices cannot be controlled, it follows that price fixing is a futile economic experiment. Where economic liberty is a priceless tradition, no individual or group of individuals can fix fair prices or establish fair price controls. Such tinkering destroys the price adjustment process and brings in its wake a host of problems which are incapable of equitable adjustment. Recently, Mr. Donald Richberg very aptly said:

"Who can be intrusted with the power to fix a fair price that will ensure justice to labor, investor and consumer? The answer is: No one, neither a private association nor a board of public officials. There is no fair price that does not depend upon the fairness of material, production and distribution costs and a fair return upon investment. But the fairness of each cost depends upon what is fair remuneration for services employed and property used. What test of fairness can we apply except the competition between willing sellers and buyers in a free market?"

It is no exaggeration to say that the major objective of most industries has been to secure through codes a substantial measure of direct and indirect price control. Certainly more business thought has been devoted to this end than to any other single objective. It is important to have a complete picture of the character and scope of price controls in codes, but unfortunately time does not permit more than a cursory presentation of conspicuous examples.

The open price provisions still found in a large number of approved codes are a favorite method of price control. As originally conceived, the open price association simply contemplated a confidential compilation of the prices received by the members of an industry in past transactions. The record was to be made available to all buyers and sellers without disclosure of the identity of the seller or buyer. The purpose was simply to afford a factual basis for the continuance of intelligent competition. In our code making, we have departed from the simple elemental principles of the open price association. We have permitted trade groups to file existing prices with a code authority composed exclusively of their own picked members who are empowered to disseminate this information to the industry. Thereafter, no change may be made in the posted prices until a waiting period of several days has elapsed and during that period all members are informed of the pending change. This type of open price association was authorized more or less indiscriminately, without regard to the number of enterprises in the industry and the degree of existing concentration and control.

Public criticism of the open price association was par-

ticularly keen and on June 9, 1934, the Administrator announced an important change of policy with respect to pending and new codes. Prices, discounts, rebates, and terms and allowances were to be filed with a disinterested agent, the price information was to be made available to both buyer and seller under certain conditions, and the waiting period for the filing of higher prices was limited to 48 hours. This new policy constituted clear recognition of the dangers of price collusion under codes. The unfortunate feature of the change was that it was largely limited to pending and new codes. A number of earlier codes had suspended the operation of the price posting system until further investigation could be made, but the major portion of industry was then codified and many industries had secured open price provision in the earlier and more attractive form. Presumably, the latter groups could adopt the new policy as a voluntary act, but obviously none were anxious to surrender their price control powers. The open price association is a wholly defensible device when applied with proper safeguards to industries where its operation can be carefully supervised; but in other cases it stimulates price fixing and control wholly inimical to the consuming public.

Practically all codes contain provisions prohibiting sales below cost. "Cost" is a highly variable concept. In general, the codes usually provide that it is to be determined by uniform standard methods of accounting, approved by independent accountants, or the code authority itself, and subject also to the approval of the Administrator. In some instances, codes provide for "reasonable" or "representative" costs similarly approved. Some specify certain items of indirect cost which must be included. One code provides for monthly appraisal of inventories and the figuring of raw material costs on prevailing market, regardless of the cost of original acquisition. Code members are guilty of unfair competition if they sell below their own costs or below the reasonable and representative costs established for the entire industry. It is customary to permit exceptions for the purpose of meeting competition below the individual cost, to close out stocks and to meet financial emergencies.

If these cost clauses result in more accurate cost finding, uneconomic pricing arising from ignorance of true costs may be reduced. But unit cost, is a function of production and it is often unknown until the total number of units to be produced and sold is known. Obviously, the cost concept must be qualified by complete power to make justifiable exceptions. It is unnecessary to stress the dangers in all forms of average and representative costs. The normal objective of all business enterprise is to sell above its costs and restrictive clauses of this type never can be sufficiently flexible to meet economic needs. They may often perpetuate uneconomic costs and seriously delay wholly beneficial price readjustments. In the vast majority of cases, government must ultimately determine whether the minimums are in accord with sound public policy for we cannot depend upon the enlightened self-interest of trade groups. Thus, we have created a situation in which an administrative agency of government is ultimately compelled to arbitrate the economic destiny of business. Such a situation is hardly in accord with our ideals of economic liberty.

Some form of price fixing is found in all distribution codes. In the general retail code the bottom limit to competition is net invoice cost or current market which ever is lower, plus 10 per cent to cover labor costs partially; in drug and cosmetic retailing, the bottom limit of prices is fixed at the manufacturers' wholesale list price in dozen lots; in the retail tobacco code, the manufacturers' list prices less small discounts for quantities sold at retail are the only lawful prices; and in the booksellers' code, the publishers' list prices for certain periods after publication, are the fixed retail prices.

The ostensible purpose of all these price control provisions in distribution codes is to eliminate the "loss leader." No one has yet given a satisfactory definition of the meaning of the term "loss leader." According to the retail code, it is an article "often sold below cost for the purpose of attracting trade." Without attempting to present the detailed economic argument against this arbitrary restriction of retail competition, it may be said that very little merchandise is ever sold at or below cost, except in connection with seasonal and other clearances. The true effect of the loss limitation provision in the general retail code is simply to broaden the basis of competition. In other words, when competition was free, a very limited number of articles were sold below net invoice cost because the loss definitely limited the practice. The main effect of this provision has been to stimulate ignorant competition or to place a premium upon stupid pricing policies. Under the drug amendment, price fixing powers have been conferred upon a group of manufacturers who have sought unsuccessfully for many years to secure a control of retail prices by legislation of resale price fixing. In this field, the minimum price is becoming the maximum price for an increasing number of articles.

In the tobacco and book codes, the manufacturer and the publisher have secured complete control of retail prices without risking a single dollar of investment in distribution. The consuming public is wholly deprived of the benefits of competition in the retailing of tobacco products and books. In these codes, a system of price control has been approved, which Congress has always refused to sanction and which the highest courts have always held to be unlawful. These codes are grave economic blunders, for they wholly ignore the principle of differential costs in retailing. As Mr. Richberg has said, "No one can be intrusted with power to fix a fair price" and the fair price is only determined by competition.

The National Industrial Recovery Act will shortly come before Congress for revision. Our code makers have wandered far afield. The plans for a benign cooperation have brougt us face to face with the dangers of a malign paternalism. We have eliminated much wholly desirable competition and the consuming public has been largely deprived of its protective influence by a widespread system of artificial and unsound price controls. Such devices seriously delay business recovery. Let us hope that the new legislation will be limited to the basic principle that competitive advantage shall not be based on exploitation of labor.

Toastmaster Wood: I am not going to take the time to discuss Mr. Walker's interesting paper. He didn't touch upon the matter of guilds which I think were instituted in England after the aulnager and searcher period. The aulnager and searcher period we might call the racketeer period. Then came the regulation of industry by industry which is probably the best form of regulation.

I was quite interested to hear that there were eggs in macaroni. I never knew that before. (Laughter.) I thought there were eggs only in noodles. (Laughter.) I know you have to use your noodle in business which, of course, some people call using your egg. (Laughter.) And I know there are a lot of bad eggs in some businesses. (Laughter.)

Talking about overproduction I think if the dyers were to adopt the method of Dr. Smith about which one of the lecturers was talking, and dye four square inches in a year or a year and a half that possibly we might have a decrease of production which would be very beneficial.

. . . Toastmaster Wood made some announcements at this time . . .

An address by Dr. Charles H. Herty, followed, which will be published in a later issue. A humorous program followed Dr. Herty's presentation and at the conclusion of this Toastmaster Wood again took over the meeting.

Toastmaster Wood: This brings to a close our Fourteenth Annual Banquet. I think we have all had a good time. Am I right, boys?

Voices: Right!

Analytical Methods for a Textile Laboratory

The Council of the A.A.T.C.C. believing that Dr. Scott's series of articles entitled "Analytical Methods for a Textile Laboratory" might well be brought together in book form, have proceeded with its publication. Copies may be obtained from the Secretary of the Association for 75 cents.

FLUORESCENCE ANALYSIS

(Continued from page (8) 10)

The type of oil used in fat liquors, and the finishing materials used are capable of identification to some extent, and valuable information on the tendency of leather to "spue" appears possible if properly studied.

PAPER

Old paper does not show any fluorescence but the various finishes when fresh have characteristic color:

Unbleached Sulfite—Violet.
Alpha Cellulose—Blue White.
Cotton Rag—Red grey.
Bleached Sulfite—Blue.
Groundwood—Grey brown.
Linen—Blue grey.

Most interesting information on the completeness of the "cook" may be obtained by noting the fluorescence of the pulp as the color diminishes with the length of time processed.

FIBER IDENTIFICATION

With practice reasonably accurate assay of the various fibers is possible. Their fluorescence is as follows:

Viscose—Deep yellow.
Texas Cotton—Yellow orange.
Natural Silk—Clear blue.
Celanese—Dull blue.
Egyptian Cotton—Pale brown.
Kemps—Bluish.

Light damage to fibers is readily recognizable as "fades" show on:

Wool as dull grey.
Silk loses its fluorescence.
Vegetable fibers, violet.

DYESTUFF IDENTIFICATION

Many dyestuffs, for example, Calcocid Rubine Extra and Calcocid Ponceau, do not show fluorescence in solution but when dyed in wool they are destructive in that property. As a rule, dyes are at their best on wool or silk and at their worst on cotton and the same dye, if it can be applied to various fibers, show quite different effects on them:

Calcozine Flavine on wool is greenish yellow.
Calcozine Flavine on Celanese is deep blue.
Calcozine Flavine on cotton is yellow.

Nitro colors, as a rule, do not show appreciable fluorescence until diazotized and developed. Diphenyl methane, Triphenyl methane and Thio compounds show up extremely well. A typical example of the possibilities of differentiation is shown by a group of various yellows on cotton:

Calcosol Yellow GK—Reddish orange.

Calcosol Yellow GC—Golden yellow.

Calcogene Yellow BC2G—Pale yellow.

Calcomine Silk Yellow G—Brown.

Calcomine Yellow 2G—Red brown.

Calco Naphthosol AS and Yellow GC Base—Black.

When examined in solution it is best to employ a dilution of 1/20000-1/30000 and trials in various solvents should be considered to secure a range of characteristic color development. Calcozine Red 6G is red orange in H_2O and green in H_2SO_4 and Calco Eosine has a similar shade in H_2O but has no fluorescence in H_2SO_4.

Inorganic salts when pure do not display fluorescence but the usual technical grade contains sufficient impurities to give marked changes. A rather high proportion of inorganic salts show a red violet fluorescence which makes differentiation difficult. Low valent compounds appear to be more fluorescent than those of higher valency. Excepting uranium salts few colored inorganic salts display fluorescence.

The best method of examination is with a fluorescent microscope and a photometer utilizing red, green and blue screens. Better effects are obtainable with a thin layer than with a thick strata.

ORGANIC SALTS

Constitution is quite characteristic and shows rather marked effects in fluorescence:

Benzyl Alcohol—Weak grey.

Benzyl Acetate—Bright violet.

Diphenylether—Violet.

Benzaldehyde—Clear brown.

Acetophenone—Weak brown.

Benzoic Acid—Violet.

Indol—Violet blue.

Different fluorescence is shown when examined in various solvents and a fairly universally used medium is a 10% solution of para dimethylamino benzaldehyde in H_2SO_4. In this schedule:

Benzene shows dark brown.

Naphthalene shows dark olive brown.

Anthracene shows grey blue.

Quinone shows bordeaux.

Quinoline shows brilliant blue.

Various organic solvents are easily recognizable when observed in the natural state:

Benzene—Violet.

Glycerol—Reddish blue.

Solvent Naphtha—Milky greenish blue.

Turpentine—Greenish blue.

OILS

Use of the spectroscope is advised and valuable information may be secured on the probable source of the oil and the detection of adulterants.

Virgin olive oil has a yellow to orange fluorescence and if refined by solvent extraction or under pressure it is violet in appearance. Second press oils are darker. Italian olive oils are orange and French oils greenish. A blue fluorescence usually indicates the oil has been heated above 150° C., or is contaminated with mineral oil.

Lubricating oils that show greenish yellow fluorescence deserve further examination as they are apt to be "gummy" in practical application.

With the spectrophotometer 5-10% adulteration can be detected when the operator is sufficiently practical. Ten to fifteen per cent additions of virgin olive oil to refined olive oil is also detectable in the same manner.

We could continue to cite illustrations of possible uses of this interesting type of analysis but time will not permit. From my sketchy outline you may draw the conclusion this work is easy and simple but I wish to emphasize to the contrary. To those who have spent sufficient time in material examinations to recognize the guide posts of identification, the paths are easier and valuable information of confirmatory character is obtainable with considerable speed. To the novice it is a hard, stony path with many detours and stop-lights.

Nevertheless I can offer any intelligent and accurate observer, who has patience, a fertile field of investigation in ultra-violet light and if I have aroused your interest or curiosity in this unique application I feel my half hour with you has been well spent. And I thank you for your courtesy in permitting me to discuss fluorescence with you and am most appreciative of the attentiveness accorded my humble presentation.

President Rose: This paper also might be discussed for a very long time but we have used up all the time already allotted to this paper so that I should like merely to say that this is an example of the value of enlarging the potential effect of our senses in our textile work. We are a little bit inclined to use our own senses and not to do what the, let us say, astronomer has done when he has been able, by examining radiant energy, to analyze even the state of atoms in stars three or four million light years away.

We thank Mr. Sampson for bringing our attention to this, and we will pass now to the next paper, "Some Applications of Sodium Metaphosphate to Textile Processes," by C. J. Munter, of Hall Laboratories, and E. B. Bell, of Calgon, Inc. (*To be published in the next issue.*)

NINETY-EIGHTH COUNCIL MEETING

THE Council held its 98th meeting in the Hotel New Yorker on Friday afternoon, December 7th. Present were President Robert E. Rose, presiding; Louis A. Olney and P. J. Wood, Past Presidents; Arthur R. Thompson Jr., Vice President; William R. Moorhouse, Treasurer; Walter M. Scott, Carl Z. Draves, Hugh Christison, William D. Appel, J. F. X. Harold and Donald H. Powers, Councilors at Large; Roland E. Derby representing Northern New England, Heyward F. Lawton representing Rhode Island, Hans Meyer representing New York, Eugene C. Knaeble representing Philadelphia, George P. Feindel representing Piedmont, Eric F. Hempel representing Mid-West, Charles B. Ordway representing South Central; and Harold C. Chapin, Secretary.

The minutes of the last meeting were approved as published. The Secretary's balance sheet of December 6th, attached hereto was accepted. The question of Year Book prices to students, new members and others was introduced and laid on the table until the next meeting. An appropriation was voted to cover assistance and compensation to the Secretary until December 7, 1935.

A cordial invitation to hold the annual meeting of 1935 in Chattanooga was received in a letter from H. B. Kimbrell, Secretary of the South Central Section, and was heartily seconded by Vice President Thompson, Malcolm Mackenzie, and R. S. Wheeler, representing the other Southern Sections. Philadelphia also was urged as the meeting place. Decision was postponed until the Council meeting in January.

Each of the following was elected to the class of membership specified, as of thirty days from publication of application, provided that no objection be received before that date by the Secretary.

Active

William Croasdale, William J. Daly, Lewis Davis, John C. Emhardt, William J. Ginsty, Edward G. Haack, William E. Keeton, James F. Kenny, John Koch, Herbert A. Lubs, Arthur R. Murphy, Kenneth B. Park, Thomas E. O'Rourke, G. W. Pierce, Frank Puleo, John F. Shea, William E. Small, John Staneck, Nathan Webber.

Junior

Sivert N. Glarum, Benjamin DeVries, Harry M. Hartnett, Arthur Hustwit, Alfred E. Koch, Arthur Spalding, John J. Tomalino, William B. Tucker.

Student

Joseph J. Crowley, William B. Ferguson, William F. Gaston, Eugene S. Horney, Carl W. Kuhl, II, William O. Neeb, Thomas D. Payne, Edward J. Phibbs, Alvine E. Shumate.

Associate

F. A. Abbiati, Frank H. Bell, Ernest Cannity, F. I. L. Lawrence, Robert E. Ockford, Garner C. Parr, Washington R. Smith.

Secretary's Balance Sheets, Oct. 31, and Dec. 6, 1934

	Applications	Dues, regular and reinstatement; net after bank charges	Dues, extra, sustaining and contributions	Dues, corporate	Miscellaneous	Totals
Received by both Secretaries, Nov. 1, '33 to Oct. 18, 1934	$812.50	$5,561.13	$275.00	$1,500.00	$550.37	$8,699.00
Received by Secretary, Oct. 18, through Oct. 31, 1934	32.50	.....	.....	.....	31.56*	64.06
Received by both Secretaries and transmitted to treasurer in fiscal year through Oct. 31, 1934	845.00	5,561.13	275.00	1,500.00	581.93	8,763.06
Received by Secretary to Dec. 6, 1934	197.50	2,818.43	145.00	1,300.00	58.03†	4,518.96
Transmitted to Treasurer	157.50	2,418.50	125.00	1,250.00	54.04	4,005.04
Leaving to order of Secretary in Appleton Bank of Lowell	40.00	399.93	20.00	50.00	3.99	513.92

* Miscellaneous through Oct. 31

Silk Wash Standards	$3.12
Analytical Methods	.83
Year Books	27.61
	$31.56

† Miscellaneous, new fiscal year

Silk Wash Standards	$1.86
American Dyestuff Reporter	.50
Year Books	50.51
Analytical Meth.	5.16
	$58.03

The following were transferred from other classifications to Active membership: B. C. Blowney, Herman Boxser, Parker H. DelPlaine, G. E. Hopkins, Jasper W. Ivey, Earle R. McLean, Robert E. Sargent, Herman C. Selya, Fred O. Tilson.

January 25th in Providence was set as the date and place of the next Council meeting.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary.*

NINETY-FIRST RESEARCH COMMITTEE MEETING

THE Ninety-first Research Committee meeting followed the Council meeting in the New Yorker, on Friday afternoon, December seventh, 1934. Present were Chairman Louis A. Olney, presiding; W. D. Appel, Hugh Christison, R. E. Derby, C. Z. Draves, W. C. Durfee, G. P. Feindel, E. Freedman, J. F. X. Harold, Ralph Hart, E. F. Hempel, F. Krassner, H. F. Lawton, H. W. Leitch, Hans Meyer, W. R. Moorhouse, G. A. Moran, H. A. Neville, C. B. Ordway, D. H. Powers, R. E. Rose, B. A. Ryberg, W. M. Scott, E. R. Schwarz, A. R. Thompson, Jr., W. S. Williams, P. J. Wood and H. C. Chapin.

Dr. Olney reported for the Committee on Research Program. Mr. Derby reported for the Carbonizing Committee, Mr. Christison for the Committee on Determination of Extraneous Matter in Textile Materials, and Professor Ordway for the Mercerization Committee. Mr. Hart presented a detailed report for the Committee on Sulfonated Oils. Mr. Durfee opened a discussion of the effect of certain textile finishing materials upon human health, to which Mr. Appel, Mr. Thompson, Mr. Wood and Professor Ordway contributed. Mr. Christison suggested work on a general method for testing efficiency of detergents, but Dr. Scott and Dr. Powers, quoting work of other investigators, expressed the opinion that any such test would have to be limited in its application to some specific class of soiling materials. Dr. Scott discussed work planned for the determination of small amounts of copper on textiles, in cooperation with Mr. Hook's committee on Determination of Sizing, Weighting and Finishing Materials.

Mr. Christison reported for the Committee on Fastness Tests for Dyed Wool. Dr. Olney stated that he had arranged for exchange of several of our Year Books for books of the Society of Dyers & Colourists on fastness standards, in order to facilitate comparison of the British tests with ours. Mr. Moran reported for the Committee on Fastness Tests for Dyed Cotton. It was voted by the Research Committee that the numbering of our fastness standards be changed so as to make number one the poorest.

The Chairman asked that all sub-committees reports be submitted early in January, to facilitate earlier publication of the next Year Book.

Respectfully submitted,

H. C. CHAPIN, *Secretary.*

APPLICANTS FOR MEMBERSHIP

Active

Chester W. Allinson—Chemist, Sayles Finishing Plants, Inc., Saylesville, R. I. Sponsors: Iver W. Fallstrom, R. A. Pingree.

Henry N. Bresette—Dyer, American Woolen Co., Webster Mills, Webster, Mass. Sponsors: Claxton Monro, Alex. Morrison.

Dale S. Chamberlin—Textile Sales Department, Warwick Chemical Co., West Warwick, R. I. Sponsors: Ernest Nathan, O. H. Forsdale.

Joseph H. Collins—Assistant Dyer, Mass. Mohair Plush Co., Western Ave., Lowell, Mass. Sponsors: Delbert E. Ray, Edward Weber.

Harry K. Kerr—Dyer, Magee Carpet Co., Bloomsburg, Penna. Sponsors: A. E. Jones, Jr., Alex C. Mackey.

Albert P. March—Textile Chemist, National Aniline & Chem. Co., 200 South Front St., Philadelphia, Penna. Sponsors: W. A. Stringfellow, Daniel McGowan.

Charles J. Sala—Demonstrator and Printing Expert, E. I. du Pont de Nemours & Co., P. O. Box 518, Wilmington, Del. Sponsors: Robert E. Rose, Geo. H. Schuler.

Theodore W. Sill—Assistant Manager of Sales, Monsanto Chemical Co., 1724 S. Second St., St. Louis, Missouri. Sponsors: F. J. Curtis, J. J. Healy, Jr.

Henry Valus—Chemist-Dyer, Armco Finishing Corp., Burlington, N. C. Sponsors: A. F. Johann, L. J. Roos.

Junior

Robert M. Oberholtzer—Dyestuff Tester, S. D. Bausher & Son, Inc., Grand St., Hamburg, Penna. Sponsors: E. C. Knaeble, Harold B. Dohner.

Thomas M. Sullivan—Night Superintendent, Algonquin Printing Co., Fall River, Mass. Sponsors: Ben Verity, Alden D. Nute.

Harry W. Watson—Dyer, Industrial Rayon Corp., West 98th and Walford Aves., Cleveland, Ohio. Sponsors: H. B. Kline, Earl W. Knapp, Jr.

Associate

Kempton Harrison—Chemical Salesman, Borden & Remington Co., 115 Anawan St., Fall River, Mass.

Al. H. Seitz—Salesman, American Aniline Products, Inc., 1218 North Front St., Philadelphia, Penn.

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WORK RELIEF OR DOLE?

THE budget estimate of the President calls for some four billion dollars to be expended on work relief to take the unemployed off the dole or direct relief and put them into work projects. This brings up the old question of whether it is for the best interests of the country at large to continue the direct relief contributions or to create work for those not employed.

In behalf of the dole it may be said that it is cheaper than work relief. Prof. Clark of Columbia University has estimated that it requires an expenditure of $3,000 per year on public works to create employment for one man. He further calculates that from this direct employment, primary or indirect employment will result which will amount to about two-thirds or possibly three-quarters of the direct employment. On the other hand it has been estimated that the cost of direct relief will average about $25 per month for a family of three or a total of $300 per year. The high cost of a public works program has caused Great Britain to discontinue this type of treatment in dealing with its unemployment problem. The high cost of work relief lies in the purchase of materials required for carrying out the project. It has been estimated that only $1 out of every $5 used on a project goes into the pay envelopes of the laborers; the rest being used up in the purchase of necessary items of construction. Projects in which little or no material is needed have been suggested as a means of dealing with this problem but such projects are naturally very limited in scope and of doubtful value.

The proponents of work relief contend that such a program tends to keep up the public morale and to make definite improvements in public property. It is, however, a question whether some of the projects have had this effect. Secretary Ickes doubtless thinks otherwise for he states that in addition to "the vast amount of employment created, the P W A program is adding billions of dollars to the real wealth of the nation in the form of new school buildings, sewer and water systems, power plants, river and harbor improvements, vast areas of irrigated and reclaimed desert land and many other types of socially and economically desirable capital assets". Harry L. Hopkins, Federal Emergency Relief Administrator in furtherance of this view states: "Work . . . preserves a man's morale. It saves his skill. It gives him a chance to do something socially useful."

The matter of the cost of relief is important. There are those who say that huge spending programs by the government will eventually undermine business confidence. A continued piling up of the government deficit may finally weaken government credit and lead to the evils of uncontrolled inflation. The burden of taxation which will have to be borne, when the time of paying off the debt arrives, does tend to make one uneasy. The cry of "Balance the Budget" which was once so familiar seems to have been discarded and dropped by the wayside. Continued spending of the public money at the present rate can only lead to painful and excessive taxation in the future.

If four billion dollars are to be spent on work relief will this not compete rather severely with private business enterprise? After all, we must recognize the fact that if business does not recover sufficiently to absorb those who will participate in this work relief within a very short time, or at least by the time this amount of money is spent, all of this spending will have gone for naught and recovery will be delayed rather than encouraged. It is not possible to add four billions to the public debt of the country year after year without adopting some heavy taxation to cover it. It seems only logical to assume that harm will result to business if the government is going to compete with it by means of the public work projects. The government has a tremendous advantage in this respect;—it does not have to show a profit to remain in business nor even pay expenses—it merely has to spend.

More to the point and no doubt more practical from a business standpoint would be to concentrate on ways and means of putting the unemployed back on the payrolls of private business rather than on government payrolls in competition with private enterprise. Whether this can best be accomplished by means of direct relief or the above discussed work relief we are possibly unqualified to judge but it does seem that business itself may have some constructive ideas in this regard which should be considered.

● CORRECTIONS

P. 715, December 31st issue. The title of the article should have read "The Determination of Absorption of Water by Fabrics."

P. 723, December 31st issue, "A Necessary Background for the Production of Quality Rayon Fabrics", (Quig), under "The Effect on Denier", 2., now reads "the maximum permissible tension is approximately 2 grams per denier for viscose and acetate rayon at 60-65% R. H." This should read "0.5 grams per denier".

P. 733, same article as above, last paragraph now reads "Figure 13 shows that silk and viscose rayon at the lower stretches have similar powers of recovery and that acetate rayon is more plastic than viscose rayon and silk for stretches of more than 35%". this should have read "3.5%".

● PERKIN MEDAL

The Perkin Medal of the Society of Chemical Industry, a distinguished honor among chemists, was presented on January 11th to Dr. George O. Curme, Jr., of the Carbide & Carbon Chemicals Corp. The occasion was a joint meeting of the Society of Chemical Industry, the American Chemical Society, the Electrochemical Society and the Societe de Chimie Industrielle, held at The Chemists' Club, 52 East 41st Street, New York City.

The award of the Medal was made several months ago by a committee representing five national chemical societies. This medal is awarded annually for valuable work in applied chemistry and Dr. Curme was chosen for his work on the development of commercial processes for synthesis of aliphatic organic compounds such as alcohol, acetone and ethylene glycol.

The first speaker on the program of the meeting was Dr. E. R. Weidlein of Mellon Institute who outlined Dr. Curme's accomplishments. Presentation of the Medal followed, Dr. Marston T. Bogert of Columbia University, a past president of the Society of Chemical Industry, making the presentation. Dr. Curme then presented his Medal Address, which was entitled "Industry's Toolmaker."

In his address Dr. Curme described the beginning of his researches on organic synthesis at Mellon Institute in 1914 and traced their development through to commercial operation in a plant built at Charleston, W. Va. in 1925. Synthetic organic chemistry is now a practical part of industry on a large and ever increasing scale, and has won its place by special achievement. He commented on earlier contributions to the textile industry and indicated new advances possible in the textile field. Dr. Curme believes that reestablishment of prosperity will come through greater production. He admits that scientific progress must be won at the price of outmoding established production facilities, but claims on the whole benefits greater than the losses. He indicated that synthetic organic chemistry would be a large factor in providing tools for reconstruction, permitting lower costs, wider distribution and better quality of products.

George O. Curme, Jr. was born in Mt. Vernon, Iowa on December 24, 1888. He graduated from Northwestern University in 1909, spent one year at Harvard University in graduate study, and received the degree of Doctor of Philosophy at the University of Chicago in 1913. He then spent a year as a graduate student at the University of Berlin under Emil Fischer. In 1914 he accepted a Fellowship at the Mellon Institute of Industrial Research at Pittsburgh, Pa., to investigate synthesis of acetylene and olefine gases and their chemical derivatives. This work was continued on an expanding scale until 1920, when the project was transferred to a semi-plant scale near Charleston, W. Va. In 1920 the Carbide and Carbon Chemicals Corp. was organized to exploit the results of the earlier research and to continue the commercial development of organic synthesis. Dr. Curme received the title of Chief Chemist of this company in 1920, Vice President and Director of Research in 1929. During his period of service with the company successful processes have been developed and put into commercial operation for synthetic production of ethylene glycol, acetone, ethyl alcohol, methyl alcohol, butyl alcohol, acetic anhydride, glycol ethers, triethanolamine and related products. This work has, in effect, created a new division of industrial chemistry based on the synthesis of aliphatic chemicals, which has become an important factor in American industry.

● 1935 SPRING SILK CARD

The regular edition of the 1935 Spring Silk Card, portraying sixty new shades, has just been issued to members of the Textile Color Card Association.

Highlighted in the card are two special color collections, captioned "The Regency Pastels" and "Peasant Colors." Ever since the introduction of these new themes in the Association's confidential advance silk card for Spring 1935, they have proved a strong fashion stimulus to the textile trades and many related style industries are likewise keying their Spring colors to these smart motifs.

The twelve "Regency Pastels" comprise Whipped Cream, Nosegay Pink, Springtime Green, Shellmist, Mignon Blue, Coral Sky, Silverstar, Directoire Beige, Empire Mauve, Boutonniere Yellow, Peachglow and Bijou Blue.

In the vivacious "peasant" group are Bavarian Blue, Czecho Gold, Roumanian Fuchsia, Basque Green, Hungarian Green, Tyrol Blue, Moujik Red, Bulgarian Green, Castilian Orange, Dalmatian Blue, Brittany Rose and Sicilian Purple.

The black color masks, "Singlets," "Twins" and "Triplets," launched by the Association, can be used effectively in conjunction with the new silk card for securing smart two and three color combinations.

OILING OF WOOL

(Continued from page 2)

temperature; also the amount of unsaponifiable matter in the olein, as this will tend to inhibit the catalytic action of metallic soaps and thus again lead to false conclusions by lowering the temperature below what it otherwise would be.

Included with such unsaponifiable matter, and having the same inhibiting or temperature-lowering effect, must be noted certain impurities or extraneous matter, such as betanaphthol. It would thus appear that there are several other factors to be taken into account before it can be certainly concluded that the rise in temperature, if any, is solely due to, and solely in proportion to, the unsaturated fatty acids present.

It has been stated also that considerable errors may be introduced in the Mackey test by using metallic wire-gauze cylinders, which may give rise to metallic soaps, having a marked accelerating effect on the self-heating properties of oils. A sample tested in an iron-gauze cylinder, attained a temperature of 100° in 1 hour and 5 minutes. An identical specimen tested in a copper cylinder reached 97° in 2 hours. A similar test in a Buckram cylinder gave less than 90° in 2 hours. Buckram, or failing that, one of the noble metals, is recommended as suitable for the gauze cylinder.

Mineral acids should be absent but fatty acids can, and in fact must, be present to a limited extent, in good oil for woolen spinning. All saponifiable oils contain fatty acids, either as free fatty acids, or in combination with the glycerol radicle as glyceride.

Olive oil contains free fatty acids 5%; glycerides 95%.

Distilled olein contains free fatty acids 95%; glycerides nil.

Fatty acids possess in general the qualities of the oils from which they are derived. Just as linseed oil is unsuitable for use on wool, so the fatty acids obtained from linseed oil are undesirable. Indeed, the results would be even more disastrous. In lubricating wool (as in most other things) extremes are unwise; just as a completely neutral oil is unsuitable, because of poor scouring, so a completely free fatty acid oil is, in the opinion of many authorities, not ideal, because the many disadvantages outweigh the admittedly easy scouring.

Some of the disadvantages of using an oil with too high an amount of free fatty acids, are as follows:—

Although mild in their action compared with mineral acids, free fatty acids do nevertheless possess a distinct affinity for iron and other metals, and in the course of time will corrode iron and steel parts of machines, storage tanks, card wires, pipe lines, etc., with which they come in contact. The reddish-brown iron soaps which are produced dissolve to a certain extent in the oil, producing a dark-colored solution which has bad staining properties. There is another risk, too, perhaps more serious than the above, viz., that patches of corroded iron may be carried bodily on to the wool, producing a local stain nearly impossible to move. Oil containing iron is also very liable to heat on the blend when sheeted up before carding.

Most mills contain workers who are possessed of sensitive skins; these unfortunate people are liable to break out in a sort of rash on their arms, etc., when in contact with oil containing too large amounts of free fatty acids.

Oils with a large amount of free fatty acidity, particularly if of a liquid type, seem to be thrown off the carding machines more easily, than are the rather heavier bodied more neutral oils. As a result, the air becomes tainted with an irritant fog of oil particles. Unless ventilation is good, this may become a menace to the health of the workers.

Generally speaking, in spite of the fact that there are certain classes of work, where only an oil with a high percentage of free fatty acids will work to the best advantage, it is generally considered that the best all around results are obtainable when oil, not extreme in either neutrality or acidity, is used. Such an oil, while containing a sufficient amount of free fatty acids to ensure a good scour, would also contain such a percentage of neutral saponifiable oil as would by better adherence to, and lubrication of, the wool in carding and spinning processes, give reduced risk of skin irritation, less corrosion of metal, and absence of card-room fog, and generally better carding and spinning right through.

● RUBBER TANK LINING

The research division of the American Hard Rubber Company of New York has just announced a very definite improvement in rubber linings for tanks used in processing operations employing highly corrosive solutions. The new lining, known as M R-10 is characterized by a high glaze surface which is said to offer greater resistance to acids and alkalis and to be more easily cleaned.

The outer layer of glazed rubber is securely bonded to a relatively thin inner layer of soft rubber which is in turn vulcanized to the steel tank. This soft rubber lamination provides an elastic contact which compensates for contraction and expansion of metal and rubber during changes of temperature. It also acts as a shock absorber to protect the lining against accident and abuse.

Another feature of M R-10 lining is the use of heavy soft rubber fillets underneath the lining in all corners. The new lining is made of a better rubber compound which is said to offer longer and more efficient service as proved by actual service and laboratory tests.

Sample test pieces are offered free to any manufacturer interested. The new lining is being offered at no advance in price.

● NUMERALS IN COLORS

Reading of multiple-point instrument records is greatly simplified by a new system of "numerals in colors" introduced by Leeds & Northrup Company, Philadelphia. This marking system can be specified on Micromax strip-chart recorders for 2, 3, 4 or 6 points. With each of the thermocouples, resistance thermometer bulbs or other primary elements identified on the chart by a numeral, and each numeral distinguished from the others by being printed in a contrasting color, reading of records is made easy, errors are avoided and time is saved. Colors used for printing the numerals are: black, green, red, violet, yellow and blue.

The print-wheel on these Micromax Multiple-Point Recorders has a separate inking pad for each point to be recorded.

A circular giving further details and showing a reproduction of an actual chart in all six colors will be sent on request. Address the above company and ask for Circular No. 314-I.

● WELFARE COMMITTEE

The Chemical & Paints Division Committee of the Citizens Family Welfare Committee consisting of: H. L. Derby, Chairman—President, American Cyanamid & Chemical Corporation; J. L. Schroeder, Vice Chairman—Vice-President, A. Klipstein & Company; Charles L. Gabriel, Vice-President, Commercial Solvents Co.; R. K. Halbach, President, General Dyestuff Corp.; Fred L. Somers, Jr., Vice-President, Lavanburg Company; Ralph Dorland, Manager, N. Y. Sales Office, Dow Chemical Co.; Max S. Weil, President, Sam'l Weil & Son; A. Lichtenstein, President, Ciba Company, Inc.; Sidney V. Smith, Vice-President, Binney & Smith; Dr. Maximilian Toch, President, Toch Brothers; Horace Bowker, President, American Agricultural Chemical Co.; Geo. A. Anderson, Vice-President, Chas. Pfizer & Co., Inc.; William S. Gray, President, Wm. S. Gray Co.; Wm. Haynes, President, Chemical Markets; Herman Johns, Western Sales Manager, Grasselli Chemical Co.; L. S. Kohnstamm, Vice-President, H. Kohnstamm & Co., Inc.; R. C. Gaugler, Treasurer, American Cyanamid & Chemical Corporation; E. C. Turner, Asst. Vice-President, Air Reduction Co.; Glenn Haskell, Vice-President, U. S. Industrial Alcohol Co.; H. B. Prior, President, Prior Chemical Co.; and Holland R. Wemple, Manager, Sales Dept., Texas Gulf Sulphur Co., raised $50,534.06 against a quota of $41,000 for 1934 made up of hundreds of contributions from employees of the two industries and 94 gifts from Corporations and individuals.

The committee wishes to express its grateful appreciation to all those who have supported its efforts and made it possible for this Committee representing the Chemical, Paint and Varnish Industries to contribute its share to the fund raised by the Citizens Family Welfare Committee for 1934.

● EVENING TEXTILE COURSES

Spring Session 1935

Textile eZ2 — *Cotton Goods Converting* (Advanced Course), 7:30 to 9:20 p. m., Monday, Room 410B, Mines Building, H. R. Mauersberger. Fifteen weeks, beginning February 11, 1935.

Textiles eZ4—*Converting of Rayon and Synthetic Fabrics* (Advanced Course), 7:30 to 9:20 p. m., Thursday, Room 410B, Mines Building, H. R. Mauersberger. Fifteen weeks, beginning February 7, 1935.

Textiles eZ6—*Design for Textiles* (Advanced Course), 7:30 to 9:20 p. m., Monday, Room 414, Engineering Building, Wm. H. Arlt. Fifteen weeks, beginning February 11, 1935.

Registration begins January 31, 1935. Instructors may be consulted during registration period 9 a. m. to 9 p. m. in Room 301, Business Building, N.E. corner 116th Street and Broadway, New York City.

● CHEMICALS AND ALLIED PRODUCTS EXPORTS

Exports of chemicals and allied products from the United States were maintained at relatively high levels during the year just ended, particularly industrial chemicals, paint products, and fertilizers, Claudius T. Murchison, Director, Bureau of Foreign and Domestic Commerce, stated recently in reviewing trends of the American chemical industry.

Exports of such products were valued at $113,000,000 during the first eleven months of the year, a value increase of 18% over the corresponding period of 1933, when exports amounted to $95,500,000. Every major group on the list, except naval stores and sulphur, shared in the value gain, he stated, and many groups showed substantial increases in tonnage.

Industrial chemicals led the list with export shipments valued at $19,588,000 during the first eleven months of the year, a gain of almost $5,000,000 over the corresponding period of 1933. Many important items of this group showed impressive volume gains.

The outlook for chemical and allied products exports for 1935 is good, Mr. Murchison stated. Dollar exchange is favorable and improved conditions in many of our best foreign markets should lead to heavier demand for American chemical products, particularly chemical specialties, phosphate and other fertilizers, paint products, and heavy chemicals, he states.

● JOINS WARWICK CHEMICAL

Dr. Dale S. Chamberlin, formerly Technical Director of the R. K. Laros Silk Company, Bethlehem, Pa., has joined the Sales Staff of the Warwick Chemical Company, West Warwick, Rhode Island. He will be in charge of the development and sale of oil products for the preparation of silk and rayon in the throwing, sizing, knitting and weaving industry.